L.L. NARAYANA* and M. RADHAKRISHNAIAH*: **Floral anatomy of Pittosporaceae (4)****

L.L. ナラヤナ・M. ラダクリシュナイア：トベラ科の花部解剖学的研究 (4)

The floral anatomy of Pittosporaceae is little known. Saunders (1939) studied the floral anatomy of a few taxa with a view to support her theory of carpel polymorphism. Subsequently Schaeppi (1971) studied the structure of gynoecium of *Pittosporum tobira*. Recently Narayana and Radhakrishnaiah (1976, 1978, 1979), Radhakrishnaiah and Narayana (1977, 1978) have studied the floral anatomy of a few genera. The present account deals with the floral anatomy of *Sollya fusiformis* Hort. and *S. heterophylla* Lindl.

Materials and methods The materials were fixed in FAA. Customary methods of dehydration, infiltration and embedding were followed. Sections were cut at a thickness of 8-12 microns, and stained with crystal violet and erythrosin.

Observations The flower is pedicallate, actinomorphic, complete, bisexual, dichlamydeous, hypogynous, tetracyclic and pentamerous except the gynoecium (Figs. 1, 16). The five sepals are free in *S. fusiformis* (Figs. 8, 10), while they show basal connation in *S. heterophylla* (Fig. 9). The sepals show quincuncial aestivation (Figs. 10, 14, 16). The polypetalous corolla shows imbricate aestivation in *S. fusiformis* (Figs. 12, 13, 15, 20) whereas it is quincuncial in *S. heterophylla* (Figs. 14, 16). The androecium consists of five free stamens; the anthers are dorsified and dithecous (Figs. 12-16, 20), the filaments are flat in *S. fusiformis* (Fig. 15) and terete in *S. heterophylla* (Fig. 14). The bicarpellary, syncarpous, superior ovary is bilocular throughout (Figs. 15-19). The style is solid and the stigma is bilobed (Figs. 1, 20, 21).

The pedicel shows a ring of five discrete vascular bundles of unequal size (Fig. 2) and these fuse to form a ring of vascular tissue in the thalamus (Fig. 3).

In *S. heterophylla* and some flowers of *S. fusiformis* ten sepal traces arise in two whorls. Five of these function as sepal midribs, whereas the alternating

---

* Department of Botany, Katatiya University, Warangal 506 009 (A. P.) India.

** Continued from Journ. Jap. Bot. **54**: 342-349 (1979).

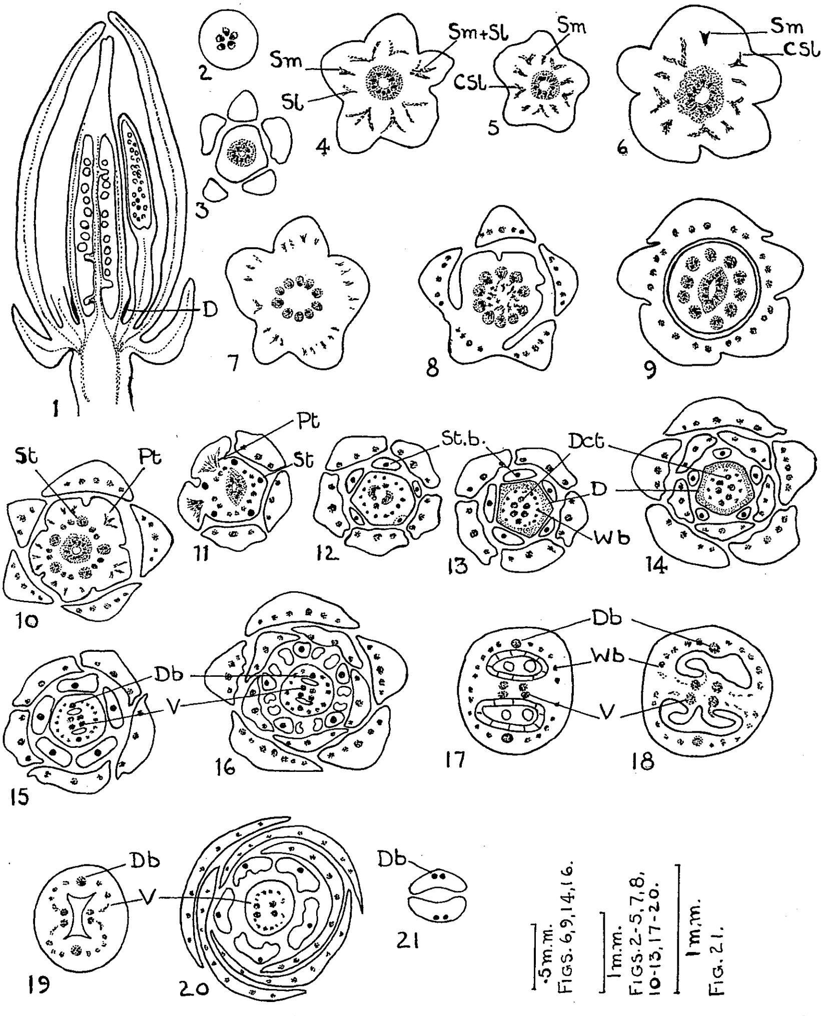

Fig. 1. Semidiagrammatic L. S. of flower, showing the course of the vascular bundles in the different floral parts. Figs. 2–21. Serial transverse sections of flower buds showing the origin and distribution to the different floral parts. Figs. 1–5, 7–8, 10–13, 15, 17–21. *Sollya fuseformis*. Figs. 6, 9, 14, 16 *S. heterophylla*. CSl=Common sepal lateral traces. D="Disc". Db=Dorsal bundle. Dct=Dorsal carpellary trace. Pt=Petal trace. Sl=Sepal lateral trace. Sm=Sepal midribd trace. Sm+Sl=Sepal midribd+Sepal lateral trace. St=Staminal trace. St. b.=Staminal bundle. V=Ventral bundle. Wb=Wall bundle.

five as common sepal lateral traces which undergo radial division to demarcate the lateral traces of adjacent sepals (Figs. 5, 6). In some flowers of *S. fusiformis* a difference in the origin of sepal traces is noticed. For two sepals, the lateral traces arise conjointly with the midrib; for the third sepal, one lateral trace arises conjointly with the midrib, whereas the other arises independently; for the fourth sepal, one lateral trace arises conjointly with the midrib, and the other originates conjointly with the lateral trace of adjacent sepal; for the fifth sepal the midrib and one lateral trace arise independently, while the other lateral trace arises conjointly with the lateral trace of the adjacent sepal (Fig. 4).

After the demarcation of the sepal traces the main stele organises into a ring of ten prominent bundles (Fig. 7), which give off branches towards inside (Fig. 8). The branches converge towards the centre to form a ring of vascular tissue (Figs. 9-11), from which a pair of dorsal bundles and two pairs of ventral bundles are organised (Fig. 12-14).

Five of the ten bundles of the main stele, which are on sepal radii, function as staminal traces and the alternating five as petal traces (Figs. 10, 11). The latter undergo tangential division as they emerge out and the bundles thus formed towards inside divide and organise into a ring of bundles which constitute the supply to the wall of the ovary (Figs. 10-16). The bundles supplying the perianth parts divide to form smaller bundles in the respective organs (Figs. 7-16, 20).

The ovary is bilocular throughout (Figs. 15-19). The loculi are lined by tangentially flattened cells (Fig. 17). The dorsal bundles lie relatively inner to the bundles that supply the wall of the ovary, for a short distance from the base and higher up they move towards the periphery (Figs. 13-19). They undergo radial division at about the middle of the style (Fig. 20). The ventral bundles of the carpels remain free throughout (Figs. 15-19). Besidies giving rise to the ovular traces they give off branches into the wall of the ovary (Figs. 18, 19).

The style is vascularised by the ventral and divided dorsal bundles (Fig. 20). The divided dorsal bundles extend up to the stigmas, while the remaining bundles fade away early (Fig. 21).

The disc-like basal peripheral portion of the ovary shows deep staining cells with vacuolated cytoplasm, and is devoid of any vascular supply (Figs.

1, 13, 14).

Discussion The flowers in Pittosporaceae are apparently simple, but floral anatomy reveals interesting differences.

A tendency towards synsepaly is noticed in the family. The calyx in *Sollya heterophylla* is gamosepalous as in *Bursaria spinosa* (Narayana and Radhakrishnaiah, 1976), while it is polysepalous in *S. fusiformis*. The sepals are 3-traced. Two types of connation of sepal-laterals are noticed in the family. In *S. fusiformis, S. heterophylla, Pronaya elegans* (Radhakrishnaiah and Narayana, 1977) and *Marianthus biqnonaceus* (Narayana and Radhakrishnaiah, 1978) there is connation between the lateral traces of adjacent sepals, while in *Bursaria spinosa* (Narayana and Radhakrishnaiah, 1976) and *Marianthus procumbense* (Narayana and Radhakrishnaiah, 1978) the sepal traces arise conjointly with the midribs. Connation between sepal traces in taxa like *S. fusiformis, Pronaya elegans* (Radhakrishnaiah and Narayana, 1977) *Marianthus biqnonaceus* (Narayana and Radhakrishnaiah, 1978) with polysepalous calyx indicates that connation of traces has preceded the external fusion of parts. The corolla is polypetalous, though gamopetalous tendency was recorded in *Marianthus biqnonaceus* (Narayana and Radhakrishnaiah, 1978). The petals at stamens are single-traced.

There is variaton in the organisation of the vascular supply to the gynoecium in the different taxa of the family investigated. In *S. fusiformis* the dorsal carpellary traces and ventral traces are organized from the branches given off towards the centre by the ten bundles in the thalamus after the organization of the sepal traces, the wall supply is derived from tne emerging petal traces. Though there is no adnation between petals, stamens and gynoecium, there is adnation between their traces. Besides, the bundles derived from the emerging petal traces, the ovary wall receives branches from the ventral bundles. Judging from the position and heterocarpellary pairing of ventral bundles and chambered condition of the ovary the placentation can be interpreted as anatomically perietal. The basal peripheral region of the ovary is glandular and is non-vascularised.

We are highly thankful to R.H. Kuchel, Dr. Hj. Eichler and Dr. J.S. Beard for sending the fixed materials of *S. fusiformis* and *S. heterophylla*.

References

Narayana, L. L. & M. Radhakrishnaiah, 1976. Floral anatomy of Pittosporaceae I. Journ. Jap. Bot. **51**: 278-282. —— & ——, 1978. Floral anatomy of Pittosporaceae II: 1978. Acta Bot. India 6: 104-197. —— & ——, 1979. Floral anatomy of Pittosporaceae. III. Journ. Jap. Bot. **54**: 342-349. Radhakrishnaiah, M. & L. L. Narayana, 1977. A note on the floral anatomy of *Pronaya elegans* Hugel. (Pittosporaceae) Curr. Sci. **46**: 866. —— & ——, 1978. Vascular anatomy of *Pittosporum floribundum* Wight and Arn. (Pittosporaceae) Curr. Sci. **47**: 167-168. Saunders, E. R. 1939. Floral Morphology, Vol II. Cambridge. Schaeppi, H. 1971. Zur Gestaltung des Gynoeceums Von *Pittosporum tobira*. Ber. Schweiz. Bot. Ges. **81**: 40-51.

* * * *

トベラ科の *Sollya fusiformis* と *S. heterophylla* の花の維管束走行を調べた。両種とも5枚のがく片，5枚の花弁，5本の雄しべ，2心皮からなる合成子房の花をもつ。*S. fusiformis* のがくは基部まで分れているが，*S. heterophylla* ではがく片の基が合着している。各がく片には3本の維管束が入るが，2本の側方維管束の分岐の仕方はやや異る。両種とも花托に10本の維管束が現われ，そのうち5本はがく片の中央維管束に入るが，他の5本は2岐して，それぞれ隣りのがく片の側方維管束となる。しかし，*S. fusiformis* の一部の花では，第3番目または第4番目のがく片で，側方維管束は中央維管束から直接分岐するものが見られた。

□高謙・張光初：**東北苔類植物志**　220 pp. 1980. 科学出版社，中国北京市． 2.2元．中国の苔類についてのフロラ的な取扱いはこれまでほとんど発表されていなく，この面での暗黒大陸といってよい。今回の上記の本は中国の東北三省（黒竜江，吉林，遼寧）の苔類をフロラにまとめたもので，55属174種が取扱われている。一部に同定の疑わしいもの（例えば *Plagiochila asplenioides* var. *miyoshiana* としてあるのは図から判断して *P. satoi* である）もある。16の新種と4つの新変種及び新品種が記載されているが，この中には明らかに synonym となるものが含まれている（例えば *Pedinophyllum major-perianthium* は *P. truncatum* と同じものである）。しかしながら，こうしてフロラにまとめられた苔類相をみてみると，日本の東北地方や北海道の苔類相とよく似ていることが分り興味深い。中国各地のこうしたフロラが早く完成することを期待したい。

（井上　浩）